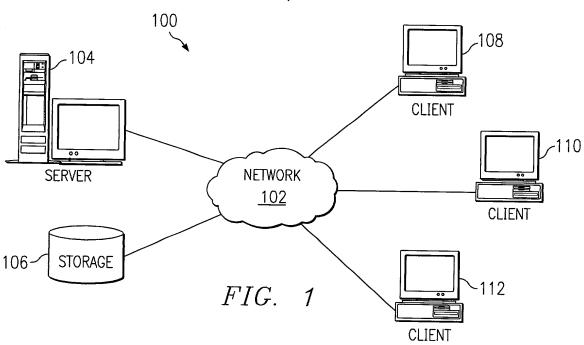RSW920010133US1
Hogstrom et al.
Method, Apparatus, and Program to Determine
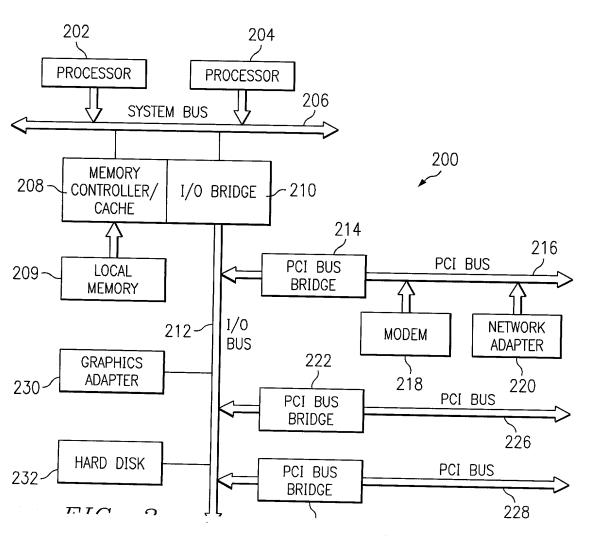the Mutability of an Object at Loading Time
1/5

FIG. 1

RSW920010133US1
Hogstrom et al.
Method, Apparatus, and Program to Determine
the Mutability of an Object at Loading Time
2/5

CLIENT
300

PROCESSOR 302

HOST/PCI CACHE/BRIDGE 308

MAIN MEMORY 304

AUDIO ADAPTER 316

306

BUS

SCSI HOST BUS ADAPTER 312

LAN ADAPTER

EXPANSION BUS INTERFACE

GRAPHICS ADAPTER

AUDIO/VIDEO ADAPTER

310

314

318

319

DISK 326

TAPE 328

CD-ROM 330

KEYBOARD AND MOUSE ADAPTER 320

MODEM 322

MEMORY 324

FIG. 3

400

404 JAVA VIRTUAL MACHINE (JVM)

PLATFORM SPECIFIC OPERATING SYSTEM
402

JAVA APPLICATION/APPLET

406

FIG. 4

RSW920010133US1
Hogstrom et al.
Method, Apparatus, and Program to Determine
the Mutability of an Object at Loading Time
3/5

FIG. 5

RSW920010133US1
Hogstrom et al.
Method, Apparatus, and Program to Determine
the Mutability of an Object at Loading Time

4/5
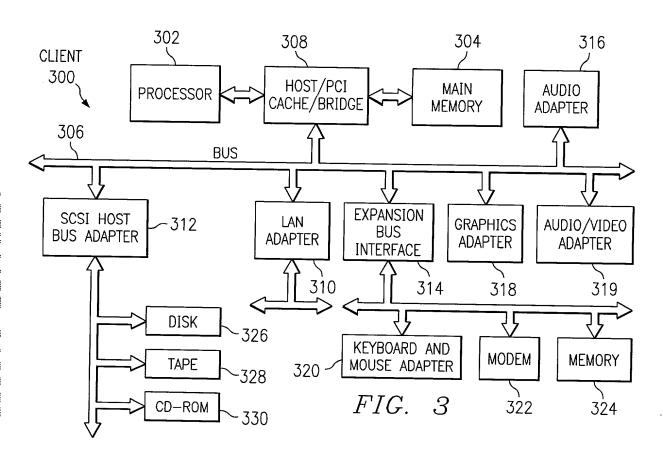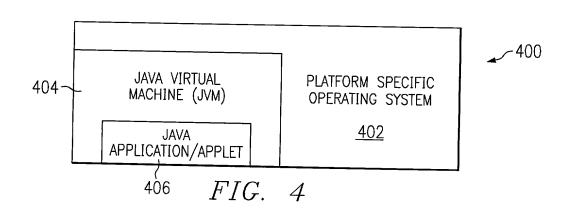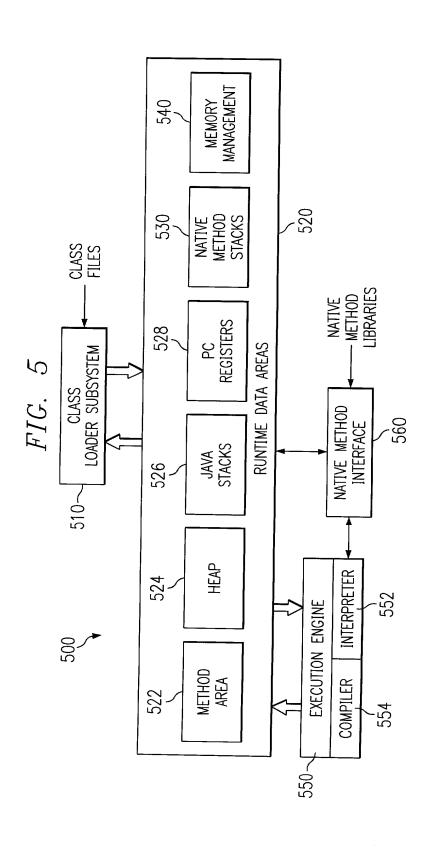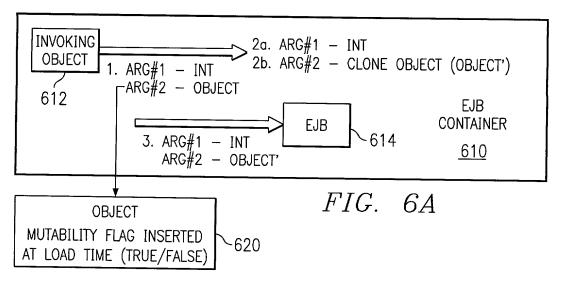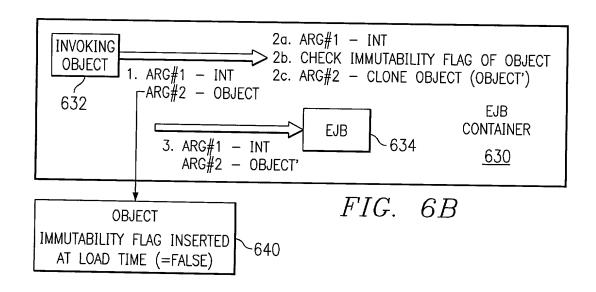
INVOKING
OBJECT

2a. ARG#1 — INT
2b. ARG#2 — CLONE OBJECT (OBJECT')

1. ARG#1 — INT
ARG#2 — OBJECT

612

EJB

614

EJB
CONTAINER

610

3. ARG#1 — INT
ARG#2 — OBJECT'

OBJECT
MUTABILITY FLAG INSERTED
AT LOAD TIME (TRUE/FALSE)

620

FIG. 6A

INVOKING
OBJECT

2a. ARG#1 — INT
2b. CHECK IMMUTABILITY FLAG OF OBJECT
2c. ARG#2 — CLONE OBJECT (OBJECT')

1. ARG#1 — INT
ARG#2 — OBJECT

632

EJB

634

EJB
CONTAINER

630

3. ARG#1 — INT
ARG#2 — OBJECT'

OBJECT
IMMUTABILITY FLAG INSERTED
AT LOAD TIME (=FALSE)

640

FIG. 6B

INVOKING
OBJECT

2a. ARG#1 — INT
2b. CHECK IMMUTABILITY FLAG OF OBJECT
2c. ARG#2 — PASS REFERENCE TO OBJECT

1. ARG#1 — INT
ARG#2 — OBJECT

652

EJB

654

EJB
CONTAINER

650

3. ARG#1 — INT
ARG#2 — REFERENCE TO OBJECT

OBJECT
IMMUTABILITY FLAG INSERTED

FIG. 6C

RSW920010133US1
Hogstrom et al.
Method, Apparatus, and Program to Determine
the Mutability of an Object at Loading Time
5/5

FIG. 7

LOAD CLASS

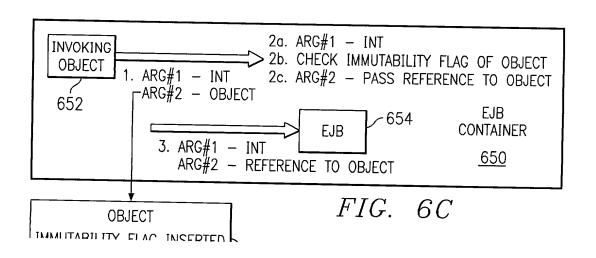702 — INSERT IMMUTABILITY FLAG INTO CLASS

704 — PARSE BYTECODE

706 — INSPECT WHETHER THE OBJECT CAN BE MODIFIED AFTER IT IS CREATED

708 — IMMUTABLE? — NO

712 — SET IMMUTABILITY FLAG TO "FALSE"

YES

710 — SET IMMUTABILITY FLAG TO "TRUE"

END

FIG. 8

RECEIVE INVOCATION REQUEST

802 — EXAMINE ARGUMENT

804 — OBJECT?

812 — IMMUTABLE? — YES

814 — CREATE CLONE AND PASS CLONE OBJECT AS ARGUMENT — NO

YES

816 — PASS REFERENCE TO OBJECT AS ARGUMENT

NO

806 — PASS ARGUMENT

808 — LAST ARGUMENT? — NO

YES

810 — INVOKE EJB